

the H.P. and I.P. cylinders with piston - valves, and to fit slide-valves to L.P. cylinders, except for fast-running engines, which often have piston - valves fitted throughout, as the power required to operate the slide - valves is considerable. When the slide - valves and gear are heavy, a balance cylinder is used to take up the weight, and in very large engines what are called "assistance" cylinders are used. They actually help to drive the valve and relieve the eccentrics and gear of much work.

There is not much variation in the design of piston-valves. Liners are invariably used. The steam may be admitted between the working ends of the valve or at the extremities. In the first case, which is the usual arrangement, the valves are said to have "inside" admission and the eccentrics are mounted on the shaft at an angle of  $180^{\circ}$  to the normal arrangement for a slide-valve. In the other case the valves have

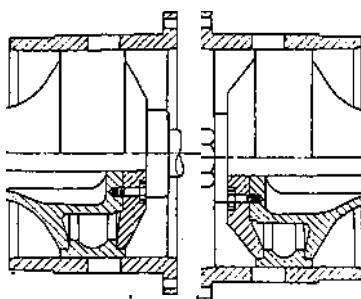


Fig. 28.—Piston Valve

" outside " admission. " Inside " admission has the advantage that the valve-rod packing is subjected to exhaust pressure only. The valves are sometimes made hollow to allow the exhaust steam from one end to pass through them to the exhaust outlet. But from a thermal point of view this is a bad arrangement because of the exchange of heat between the exhaust steam and the inlet steam.

Valving packings are of many types. Plain floating rings are often used, but one of several well-known proprietary types which have proved satisfactory in service is often specified. Fig. 28 shows an example of piston-valve design of Messrs. Scott &

Co.

**Columns.**—These are usually of cast iron, of plain shape tapering from the smallest section at the top, and of rectangular box-section. The stress at the smallest section is kept low, from 500 to 600 lb. per square inch as the load alternates from tension to compression, and water in the

cylinder may cause severe shocks. Two columns are used for each cylinder, one on each side of the crank-shaft. In some cases the front columns are of forged steel. These have to sustain an alternating load, and are therefore in much the same condition as the piston-rod, but are longer. On the other hand, they have to sustain only half the piston load, and are well secured at the ends, so that their diameter may be based upon a stress of